A COMPARISON OF SPECIAL EDUCATION STUDENTS WITH REGULAR STUDENTS USING AUDIO AND VISUAL STIMULI

An abstract of a Field Report by
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The problem. The purpose of this study was to compare the reaction times of three selected junior high school populations: learning disabled, regular, and mildly mentally disabled to a simple audio and visual stimuli.

Procedure. The Automatic Performance Analyzer was used to test the simple reaction times of the fifty-four students. Each person was given ten individual trials for measurement of his/her reaction time to a simple stimuli. Each students was allowed five trials with the audio stimuli and five trials with the visual stimuli. During each trial, the length of time from activation of the stimuli to the presentation of the stimuli was varied. All reaction time scores were recorded to the nearest one-one hundredth of a second.

Findings. Reaction time to an audio and/or a visual stimuli may vary from student to student; however, such similarity or variance is neither dependent upon nor an operation of the classification of that student at the junior high school level as either learning disabled, regular, or mildly mentally retarded. It may be further stated that a student's membership in any of these groups cannot be accurately predicted by that student's reaction time score(s).

Conclusions. Four conclusions can be made as a direct result of this investigation. First, no one group (L.D., Reg., and M.D.) showed significantly higher or lower reaction time scores to an audio or visual stimuli. Second, group placement (L.D., Reg., and M.D.) had no significant impact on an individual's reaction time scores to an audio or visual stimuli. Third, no accurate predictions with respect to placement (L.D., Reg., and M.D.) can be made based upon either of his/her reaction time scores to an audio and/or visual stimuli. Fourth, if a person scored slowly, moderately, or rapidly to an audio stimuli, he/she also scored slowly, moderately, or rapidly to a visual stimuli.

Recommendations. Based on the findings in this investigation, it is recommended that further research be conducted. A more complex audio and visual stimuli should be used with a wider population base.

A COMPARISON OF SPECIAL EDUCATION STUDENTS WITH REGULAR STUDENTS USING AUDIO AND VISUAL STIMULI

A Field Report

Presented to

The School of Graduate Studies

Drake University

In Partial Fulfillment

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SPECIALIST IN EDUCATION

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by

Theodore Joseph Nemmers

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Chapter 1

INTRODUCTION

In 1973 the researcher accepted employment in the Des Moines Independent School District as a teacher of special education for the mildly mentally disabled. The initial placement was in a junior high school. Staffing of students in the mentally disabled program appeared to be informal and subjective. This approach raised some questions as to whether or not current placement procedures were valid. As a result, the researcher developed an interest in the possibility of developing a sounder approach to the screening of students for the mildly mentally disabled program.

RATIONALE FOR THE STUDY

Present research suggests that most intelligence scales measure mental capacity by presenting standardized questions and tasks to students. For most special education students, the use of intelligence tests needs to be supplemented with other kinds of data such as sociograms, physical examinations, case studies, classroom observations by professional persons, and achievement tests in order to determine proper school placement of these students. All of these diagnostic techniques supply valuable information, and yet it appears that other important data

gathering processes should be utilized. An approach that could be employed to help one more accurately assess the potential of each individual is to make a quantitative analysis of reaction time.

David Weschler indicated in the introduction to the Weschler Intelligence Scale that major emphasis of intelligence tests is on the use of psychometric devices. He stated it in the following manner:

> From the view point of their avowed intent and wide use intelligence tests are psychometric devices--in practice sets of standardized questions and tasks, for assessing an individual's potential for purposive and useful behavior, at least in those aspects of it which one agrees to designate as intelligent. To be sure, there are many different definitions of intelligence, but nearly all intelligence scales appraise it in much the same way, namely by measuring a subject's mental abilities or current intelligence capacities.[1]

With the passage of Education of All Handicapped Act of 1975, Public Law 94-142, there is a greater need for accuracy in the placement of students in an educational environment that, hopefully, will permit them to develop to their maximum potential. The challenge of this law requires teachers, parents, administrators, and boards of education to be more objective and definitive in providing the kinds of educational programs that are least restrictive and most educationally advantageous to students.

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[1]Weschler, David, Weschler Intelligence Scale for Children (New York: The Psychological Corporation), Rev. 1974).

Specifically, Public Law 94-142, mandates that the following provisions be implemented:

> . . . that all children residing within the jurisdiction of the local educational agency or the intermediate educational unit who are handicapped, regardless of the severity of their handicap, and are in need of special education and related services will be identified, located, and evaluated, and provide for the inclusion of a practical method of determining which children are currently receiving needed special education and related services and which children are not currently receiving such education and services.[2]

SIGNIFICANCE OF THE STUDY

Frequently, persons of educationally deviant population groups are placed in special programs for reasons that may appear to be irrelevant and unrelated to their individual educational needs. Many factors could be attributed to such placements. The instruments that are used by school districts for assessing a student's level of potential for achievement may be insufficient. The cost of a total and comprehensive evaluation by persons not associated with the district could be a financial burden to both the student's family and the school district he or she attends. Questions addressing the effectiveness of the various tests and evaluative processes are numerous.

Confronted with the fact that every person, regardless of his or her level of competency, possesses a myriad of abilities, the initial task was to isolate a specific competency that upon testing

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[2]Public Law 94-142, Education of All Handicapped Act of 1975, Sec. 614, Par. 1-(A).

might serve as a discriminating variable. Since it has long been postulated that the ability to cerebrally process information is a significant discriminator among the populations defined as learning disabled, regular and mildly mentally disabled, it was proposed that a procedure that would measure information processing in its most simplistic form might pave the way for the development of a type of gross screening that could significantly discriminate among these populations. It was supposed that a procedure similar to the pure-tone hearing examination for assessing gross hearing acuity or the Snellen eye-chart examination for measuring gross visual acuity should be investigated. The development of a procedure to cut costs, save time, and improve referral procedures for further evaluations would be beneficial to both the student and to the school district responsible for educational and treatment services.

A curosry review of the literature revealed that a limited amount of experimentation has been attempted with reaction time to simple audio and visual stimuli as a tool in the screening and assessment process. It was determined that further investigation of reaction time to simple stimuli as a potential for assessment screening purposes should be pursued.

STATEMENT OF THE PROBLEM

The purpose of this study was to compare the reaction times of selected populations to both simple audio and simple visual stimuli. In this study, the following populations were compared:

1. Mildly mentally disabled students were compared with learning disabled students.

2. Mildly mentally disabled students were compared with regularly placed students.

3. Learning disabled students were compared with regularly placed students.

HYPOTHESIS OF THE STUDY

Three null hypotheses were examined:

1. There is no difference between the reaction times obtained from a measure of visual and audio stimuli of students placed in classes for the mildly mentally disabled and students placed in learning disabled classes.

2. There is no difference between the reaction times obtained from a measure of visual and audio stimuli of students placed in classes for the mildly mentally disabled and students placed in regular classes.

3. There is no difference between the reaction times obtained from a measure of visual and audio stimuli of students placed in classes for the learning disabled and students placed in regular classes.

ASSUMPTIONS

The basic assumptions made in the study were:

1. If any physical impairments occur, their frequency of occurrence will be the same for each of the populations.

2. The testing environment (conditions) and instructions are the same for all subjects.

3. The populations have been tested, defined, and diagnosed by the Des Moines Independent School District and are accepted as valid.

4. The physical attributes that influence reaction times are the same for all participants.

LIMITATIONS

In this study, the following limitations are identified:

1. There were no selected samplings.
2. The selected population was restricted to one junior high school.
3. The selected population does not represent a true cross-section of the community.
4. There were no pre-tests for physical impairments.
5. The researcher had no control over definitions, selections, and placement done by the school district.

DEFINITIONS OF TERMS

For the purpose of this study the following definitions apply:

1. Mental disability is the inclusive term denoting significant deficits in adaptive behavior and sub-average general intellectual functioning. For educational purposes, adaptive behavior refers to the individual's effectiveness in meeting the demands of one's evidenced by performance greater than one standard deviation below the mean on a reliable individual test of general intelligence valid for the individual pupil.[1]
2. Learning disability is the inclusive term denoting deficiencies which inhibit a pupil's ability to efficiently learn in keeping with one's potential by the instructional approaches presented in the usual curriculum and require special education programs and services for educational progress.[2]
3. Regular placement is the term for students not found in any remedial, talented, or gifted classification.
4. Simple audio stimuli is a buzzer that is activated mechanically.

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[1] Iowa Code, Title X, Chapter 12, 4 (B).

[2] Ibid. 4 (E).

5. Simple visual stimuli is a light source activated mechanically.

6. Automatic Performance Analyzer is built around a time indicator that is calibrated in and accurate to time in 1/100ths of a second. The equipment was designed for the purpose of measuring movement, reaction, or both by the recording of time intervals.[3]

METHODOLOGY

Fifty-four junior high school students equally distributed among learning disabled, regular, and mildly mentally disabled were tested. The students were tested on reaction times to a simple audio and visual stimuli. A linear frequency distribution graph, Spearman Rho correlation, t-test of significance of means, an analysis of variance of interaction of significance of means, and a multiple correlation of predictability were used to analyze the data.

ORGANIZATION OF THE REMAINING CHAPTERS

A review of the literature that is related to reaction time of learning disabled, regular and mentally disabled students is presented in Chapter Two. The design of investigating reaction time among the groups is presented in Chapter Three. The presentation and analysis of data obtained in this study is done in Chapter Four. The summary, conclusions, and recommendations

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[3]Dekan Timing Devices, Automatic Performance Analyzer, Glen Ellyn, Illinois, Model 631.

that are a direct result of this study are presented in Chapter Five. The informational background presented in the related literature will provide the reader with a perspective as to the studies of reaction time and their relationship to deviant and normal populations.

Chapter 2

REVIEW OF THE LITERATURE

Throughout the literature many researchers have defined reaction time. Basically, reaction time can be subdivided into various components. Botivinick and Thompson at Duke University factored reaction time into pre-motor and motor components. They stated:

> The pre-motor time was the stimulus to the appearance of increased muscle firing, while the motor time was that period from this change in action potential to the finger lift response. Pre-motor time was poorly correlated with reaction time.[1]
>
> (Botivinick and Thompson define pre-motor components as reception and interpretation of stimulus. They define motor component as muscular response to a stimulus.)

Another component of reaction time was stated by Hohle as a period prior to the initial muscle response from a stimulus and a period after the initial muscle response. He stated:

> Variation in reaction time was due primarily to variation in the period from presentation to the stimulus to the initial muscle response. Variation was not due to the period from the initial muscle response to the completion of the act.[2]

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[1]Jack Botivinick and Larry W. Thompson, "Pre-Motor and Motor Components of Reaction Time," Journal of Experimental Psychology, LXXI (January, 1966), pp. 10-12.

[2]R. H. Hohle, "Inferred Components of Reaction Time as a Function of Foreperiod Duration," Journal of Experimental Psychology, LXIX (December, 1965), p. 383.

Jones and Benton tested from simple reaction time to both audio and visual stimuli using educable mentally retarded and normally placed children.[1] An attempt was made in their investigation to evaluate the relative importance of mental age and chronological age as determinants of simple and choice reaction times in the two groups. The impetus for their study came from preliminary observations on reaction time in normal children and mental defectives (matched for mental age) which suggested that at lower mental age levels (6-7 years) the normal children were faster. The conditions of these observations included audio and visual stimuli that required hand lift movements. The apparent reversal in the direction of the intergroup difference with increasing age raised the question as to whether or not the factor of physical maturity (as indexed by chronological age) may interact with the factor of mental age in determining speed of response.

The subjects were tested on selected auditory reaction time tasks and visual reaction time tasks. The results were:

> The normals responded more quickly than the retarded under all conditions. Further, when the results of group differences in chronological age and not mental age were compared, there were

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[1]David Jones and Arthur L. Benton, "Reaction Time and Mental Age in Normal and Retarded Children," American Journal of Mental Deficiency, LXXIII (July, 1968), p. 143.

> significant differences between normal and retarded subjects. Finally, simple choice reaction times correlated highly with mental age and chronological age in both subject categories.[1]

To support the above study of Benton and Jones, an experiment was conducted by Baumeister and Kellas.[2] In their experiment, six normal and six mentally retarded subjects were compared on a simple reaction time task. Several hundred responses were obtained for each subject. "The distribution of responses for the retarded tended to be more variable. All normal subjects typically skewed the curve to the right, indicating that the normal subjects' scores were higher and more consistant than the mentally retarded."[3]

A separate study by Kellas concerned itself with simple reaction time.

> A simple reaction task was employed in which between and within--subjects response variability was examined for both normal and retarded males. In both ability groups, reaction time variability was functionally related to the direction of the reaction-time response and reaction signal intensity. Both between- and within- the subjects' variability was greater for the retarded male than the normal males.[4]

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[1] Ibid. p. 145.

[2] Alfred A. Baumeister and George Kellas, "Distribution of Reaction Time of Retardates and Normals," American Journal of Mental Deficiency, LXXII (March, 1968), p. 716.

[3] Ibid. pp. 534-353.

[4] George Kellas, "Reaction Time and Variability of Normal and Retarded Adults," American Journal of Mental Deficiency, LXXIV (November, 1969), p. 410.

In a comparison of normal adults and retarded adults, Hawkins used a variation in complexity of a signal.[1] The results indicated that normal subjects responded faster than did mentally retarded subjects.

Similarly, Nettelbeck and Brewer compared retarded and non-retarded adults in two experiments using an eight choice reaction time task.[2] The stimuli used were lights that could be adjusted to various lengths from subjects. Their findings showed the following:

> Both groups responded more slowly when stimuli were distant, this effect being more marked for retarded subjects. Patterns of latencies suggested that, compared with non-retarded subjects, retarded subjects inspected information input for longer periods of time and made more inspections before responding. Faster reaction times to stimuli nearest the ends and midline of the display and to stimulus repetitions indicated that retarded subjects were more reliant upon more discriminable cues in the stimulus display.[3]

In contrast to the studies previously mentioned, Henry found that individual reaction times were independent and unrelated

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[1]William Hawkins, "Reaction Time of Normal and Retarded Adults," American Journal of Mental Deficiency, LXIX (July, 1965), p. 152.

[2]T. Nettelbeck and N. Brewer, "Effects of Stimulus-Response Variables on the Choice Reaction Time of Mildly Retarded Adults," American Journal of Mental Deficiency, LXXXI (July, 1976), p. 90.

[3]Ibid. p. 90.

to intelligence.[1] A more moderate position of factors relating to reaction time comes from research by Rapin and Steinherz in 1970.[2] They found that:

> A substantial part of reaction time, the time elapsed between presentation of a stimulus and the subject's response reflects a central delay during which the brain processes the input and elaborates a response. Low stimulus intensity, inefficient central processing and lack of motivation are among factors which prolong reaction time.[3]

Berkson tested sixteen mentally deficient and fifteen normal adolescent boys on reaction times on three tasks varying in complexity.[4] The speed of hand lifting and ballistic movement was measured. On both measures, the retarded were slower than the normals and the more complex tasks elicited slower responses. Berkson concluded his study by stating:

> Intelligence is not related to factors governing the speed of stimulus identification nor to the planning of the response. Rather the slow reaction time was due to motor components responsible for initiating the executing movement.[5]

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[1]Franklin Henry, "Reaction time--Movement Correlations," Research Quarterly, XII (February, 1961), p. 64.

[2]Isabelle Rapin and Peter Steinherz, "Reaction Time for Pediatric Audiometry," Journal of Speech and Hearing Research, XIII (March, 1970), p. 207.

[3]Ibid. p. 207.

[4]G. Berkson, "An Analysis of Reaction Time and Mentally Deficient Young Men," Journal of Mental Deficiency Research, IV (February, 1960), pp. 59-61.

[5]Ibid. pp. 59-61.

Dingman and Silverstein concur with Berkson that slower performance of mentally retarded persons on simple "Perceptual motor skills tasks can be accounted for almost entirely by factors associated with motor disability."[1]

In the last decade, many studies have been conducted concerning reaction time. A new term, "refractory period," has come from these studies. The refractory period, according to Ellis, "is the time between stimulation and response in muscle and nerves."[2] Subjects in one particular experiment completed simple and paired time responses to visual signals and the procedure for the subjects varied only in respect to the duration of the stimuli. The major findings were:

1. The duration of signal had no significant effect upon either simple or paired reaction times.

2. Delays in the second reaction time paired responses persisted throughout the entire range of 50-500 milliseconds between signals.

3. When the intervals between signals were greater than the first reaction time in paired responses, the second reaction time was inversely related to the interval between signals.

4. The first reaction time in paired responses was significantly longer than the simple reaction time for that number.[3]

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[1]H. F. Dingman and A. B. Silverstein, "Intelligence, Motor Ability, and Reaction Time in the Mentally Retarded," Perceptual Motor Skills, XIX (March, 1964), p. 792.

[2]N. R. Ellis, ed. Handbook in Mental Deficiency: Psychological Theory and Research (New York: McGraw Hill, 1963), p. 168.

[3]Ibid. p. 175.

The related literature has shown that only in the past decade have significant studies been made of matched reaction times between normal and deviant populations. The related literature reviewed and cited can be divided into three areas. The first area demonstrates the relationship of reaction time responses to I.Q. scores. The second area relates to intelligence by virtue of motoric responses. The last area shows no relationships between I.Q. scores and reaction time.

In Chapter Two, the related literature reviewed and/or cited was important and significant in setting the tone and establishing a feeling for this study. While there was limited information directly related to this study, it nevertheless provided a sense of direction and purpose. Furthermore, the literature reviewed revealed little concerning reaction time between normal and/or retarded persons with other identified deviant populations such as learning disabled. Studies of this type could provoke a clearer delineation of reaction time to intelligence, motoric ability, perceptual ability, or other competencies. To increase understanding of the manner in which reaction time may relate to individual abilities such as those mentioned, this study was conducted and analyzed as described in the next chapters.

Chapter 3

PROCEDURE

GENERAL DESIGN

This investigation was designed to study the reaction times of three selected junior high school level populations, learning disabled, regular, and mildly mentally disabled, to a simple audio stimuli and a simple visual stimuli. The investigation developed from the proposition that should it be possible to demonstrate reaction time significantly different among these groups such demonstration might possess the potential as a gross screening device for educational group classification.

Permission to conduct this study was obtained from the administrators of the Des Moines Independent School District.[1] A letter was sent to the parents requesting and encouraging them to cooperate as fully as possible. The letter also explained the nature of the study.[2]

The testing of the reaction times was done by the use of the Automatic Performance Analyzer. Each person was given ten individual trials for measurement of his/her reaction time to a simple stimuli. Each student was allowed five trials with

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[1] See Appendix A.

[2] See Appendix B.

the audio stimuli and five trials with the visual stimuli. It should be noted, that before each phase of testing, two practice trials were given for each stimulus used. This demonstrated to the individual how the apparatus worked.

During each trial, the length of time from activation of the stimulus to the presentation of the stimulus was varied. Each student was tested five times with varying lengths on the visual stimuli and five times on the audio stimuli.

POPULATION AND SAMPLE

In this study, the mentally disabled students and the learning disabled students were selected on the basis of their identification and placement in their respective programs. In the aforementioned populations, both males and females were represented in grades seven, eight, and nine. Each respective group contained eighteen members.

From the regular student population, a selected sample of eighteen students was taken which included both male and female students enrolled in seventh, eighth, and ninth grade junior high English classes. The sampling process was done with the aid of the guidance counselors who were asked to submit the names of all students in regular English classes. The names were written on a piece of paper and a corresponding number of names was drawn to make all groups equal.

DATA AND INSTRUMENTATION

One measurement taken was the reaction time to a visual stimulus, measured at 1/100 of a second. The other measurement collected was the reaction time to an audio stimulus, which was measured at 1/100 of a second.

The instrument used was the Automatic Performance Analyzer. It was chosen for the following reasons:

1. The instrument is portable and can be moved to different locations with ease.
2. The test can be administered without any previous technical knowledge or skill.
3. The Automatic Performance Analyzer is accurate at 1/100 of a second.

ANALYSIS

This study will be analyzed by the use of five separate procedures. These procedures will include a linear frequency distribution graph, a Spearman Rho correlation, a t-test of significance of means, an analysis of variance of interaction of significance of means, and a multiple correlation of predictability. Such statistical treatment of the data was considered necessary in order to completely and accurately demonstrate the full range of relationships and differences, if any, that possibly exist within a comparative framework of the responses of individuals as members of three separate groups to two separate stimuli.

Chapter 4

PRESENTATION OF DATA

The reaction time to simple audio and simple visual stimuli data accumulated from this study was analyzed by five separate procedures for the purposes described as follows:

1. A linear frequency distribution graph of audio reaction time scores and visual reaction time scores for each group (L.D., Reg., and M.D.). This graph provides a visual comparison of the distribution of responses for each student to each variable by his/her assigned group. The procedure would reveal the visually identifiable relationships and/or differences, if any, of the distribution of audio scores and visual scores between or among all groups.

2. A Spearman Rho correlation comparing the rank-order correlations of each variable within each group. This correlation provides the comparison of a reaction time score to audio stimuli to a reaction time score to visual stimuli for each student on a rank-order scale within each group. This procedure would reveal the relationship of the pattern of audio scores to visual scores within each group which can then be compared with the pattern of scores to the other groups.

3. A t-test comparing the mean scores of each group on each variable with the mean scores of each of the other groups on the same variable. This test provides a comparison of the mean scores on each variable between all possible combinations of group comparisons to determine the significant difference, if any, of variable mean scores. This procedure would reveal the significant differences, if any, of audio mean scores to visual mean scores between each of the groups, compared to each other.

4. An analysis of variance comparing the mean scores of each variable (audio and visual reaction time scores) across all three groups. This analysis provides the comparison of the combined mean scores

for each variable across groups with the combined mean scores of both variables across groups, in a two-way comparison and a three-way comparison. This procedure would reveal the significant differences, if any, of mean scores in combinations where a comparison of three groups together simultaneously is necessary to demonstrate interaction of variables.

5. A multiple correlation comparing the predictive value of each variable (audio and visual reaction time scores) to group membership and the predictive value of combined variables to group membership. This correlation or multiple regression provides the comparison of variable scores, either alone or in combination, to predict group membership. This procedure would reveal the predictability, if any, of a variable (audio and/or visual) to group membership. That is, if a variable were demonstrated to be predictable for membership among the groups, a student's group membership could be predicted by his/her variable score.

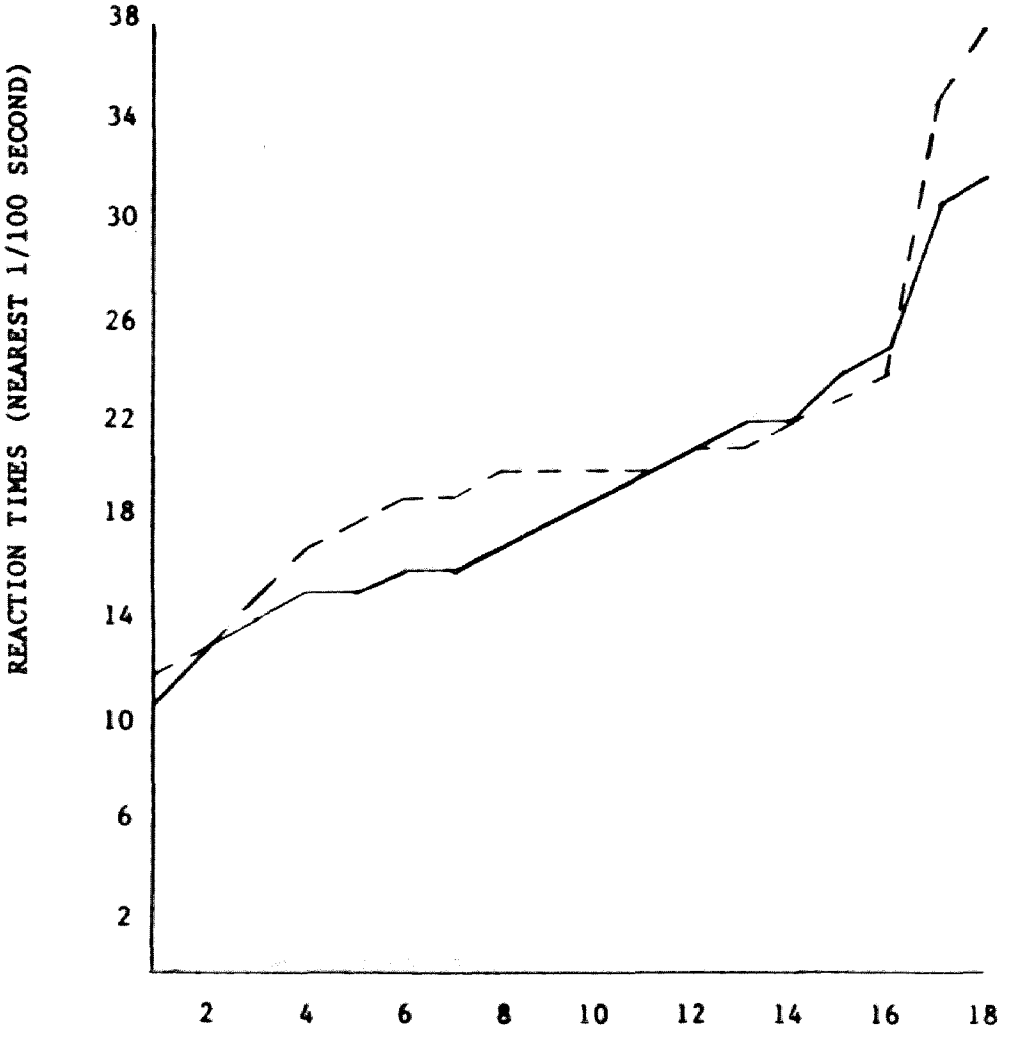
The reaction time scores of audio and visual responses of individual students within each group is illustrated by the linear graphs showing frequency distributions. (See figures 1, 2, and 3.)

The graphs reveal both a visually identifiable similarity within each group (audio scores are closely related to visual scores for students as a whole within each group) and also among the three groups when compared to one another (audio and visual scores are closely related in frequency distribution across groups). It may therefore be stated that visual examination of the linear graphs reveals that the distribution of audio and visual reaction time scores for individuals within each group not only

Figure 1

ACTUAL AUDIO AND VISUAL REACTION

TIMES OF LEARNING DISABLED STUDENTS



KEY:

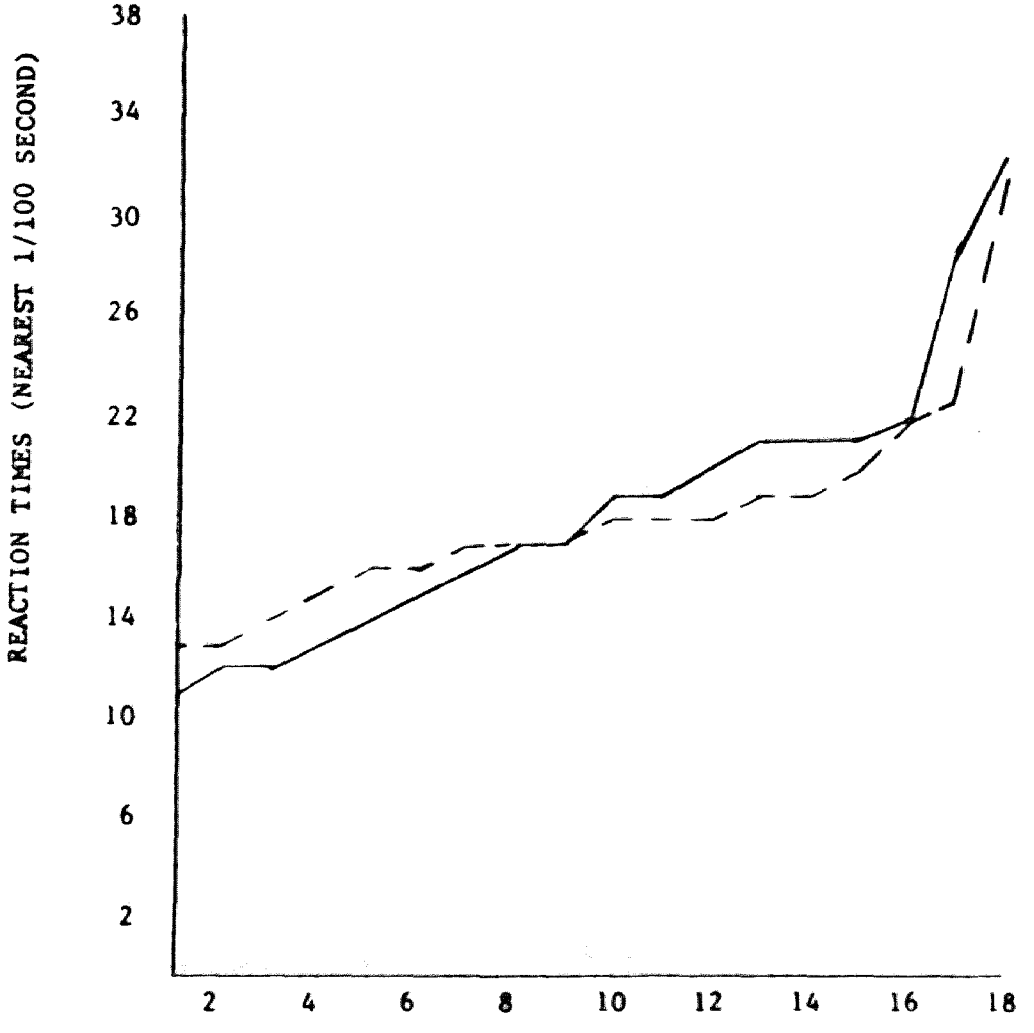
_____Audio

- - - - - - - - - -Visual

Figure 2

ACTUAL AUDIO AND VISUAL REACTION

TIMES OF REGULAR STUDENTS



KEY:

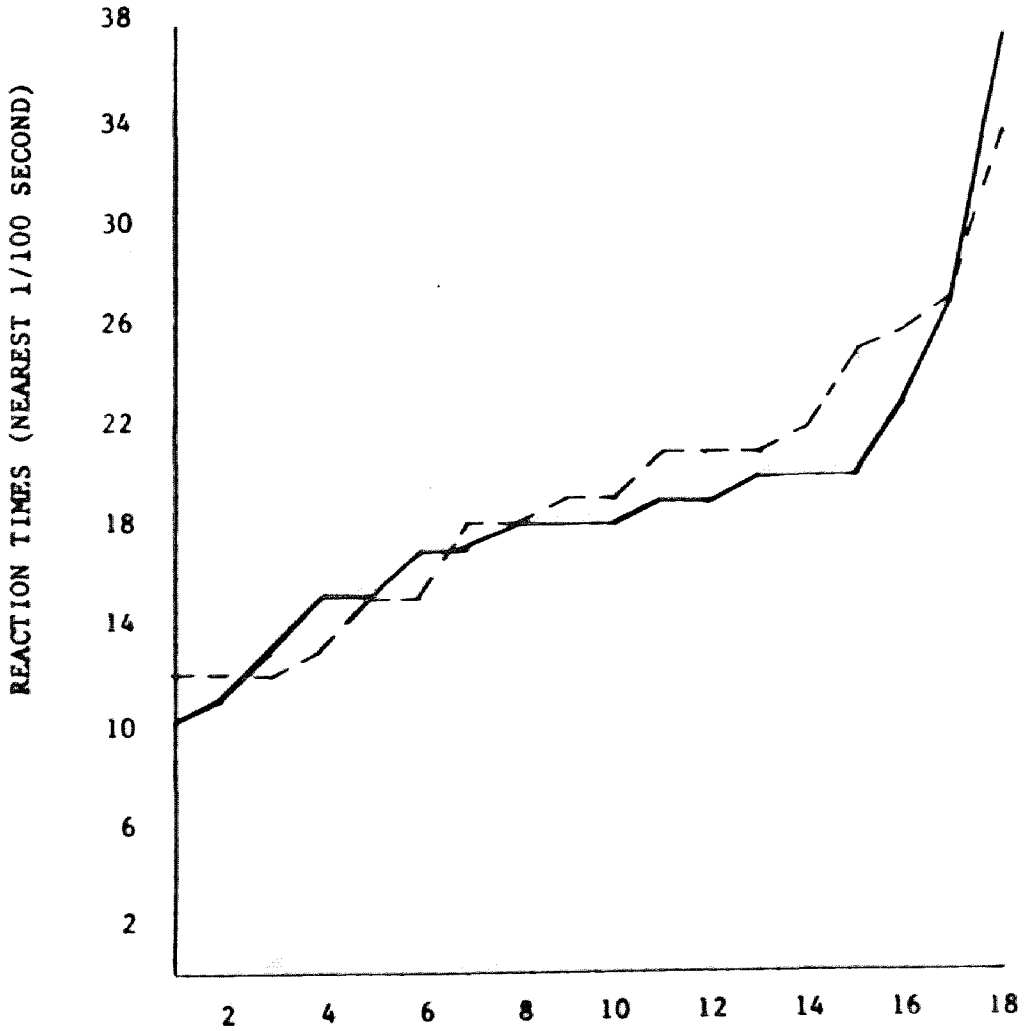
_____Audio

----------Visual

Figure 3

ACTUAL AUDIO AND VISUAL REACTION

TIMES OF MENTALLY DISABLED STUDENTS



KEY:

_____Audio

----------Visual

lie within close proximity to each other, but, also that the frequency distribution curves for each group are in close proximity to those of the other two groups; hence, a relationship appears to exist upon visual examination.

Although a relationship is identifiable by observing the graphs, the extent of that relationship is more accurately measured with a Spearman Rho rank-order correlation.

The Spearman Rho correlation method was used to examine the rank-order correlation between the two reaction time scores (audio and visual) of each individual within each group (L.D., Reg., and M.D.). This procedure would reveal the relationship of reaction time scores of the two variables (audio and visual) by group. (See tables 1, 2, and 3.)

Calculation of the Spearman Rho indicated a high correlation of the audio reaction time score and the visual reaction time score for each student within each group. That is, for any student within a group, the reaction time on one variable was positively correlated with the reaction time on the other variable.

This can be demonstrated by the following general statements for the pattern of responses, regardless of group membership:

Slow audio R.T. = Slow visual R.T.
Moderate audio R.T. = Moderate visual R.T.
Rapid audio R.T. = Rapid visual R.T.

This pattern of responses held for each of the three groups (L.D., Reg., and M.D.).

TABLE 1

SPEARMAN RHO OF
VISUAL AND AUDIO RT
OF LEARNING DISABLED STUDENTS

N	Visual RT	Audio RT	RTX	RTY	Diff (x-y)	$Diff^2$
1	37.8	31.5	18	18	0	0
2	35.0	21.8	17	14	3	9
3	23.9	23.9	16	15	1	1
4	22.8	31.0	15	17	2	4
5	22.3	24.9	14	16	2	4
6	21.4	21.2	12.5	12	.5	.25
7	21.4	17.8	12.5	9	3.5	12.25
8	20.0	19.7	11	11	0	0
9	19.9	16.0	10	7	3	9
10	19.8	14.8	9	4.5	4.5	10.25
11	19.5	21.7	8	13	5	25
12	19.1	16.5	6.5	8	2.5	6.25
13	19.1	15.9	6.5	6	.5	.25
14	18.0	14.8	5	4.5	.5	.25
15	16.9	18.6	4	10	6	36
16	14.7	13.4	3	2	1	1
17	12.8	13.5	2	3	1	1
18	11.5	11.3	1	1	0	0
						$D^2 = 126.25$

$$P = 1 - \frac{6 \times 126.25}{18\ (324 - 1)}$$

$$P = 1 - \frac{757.50}{18\ (324 - 1)}$$

$$P = 1 - \frac{757.50}{5814}$$

$$P = 1 - .13$$

$$P = .87*$$

*Significant above .8

TABLE 2

SPEARMAN RHO OF
VISUAL AND AUDIO RT
OF REGULAR STUDENTS

N	Visual RT	Audio RT	RTX	RTY	Diff (x-y)	$Diff^2$
1	32.4	32.6	18	18	0	0
2	22.8	20.7	17	14	3	9
3	21.9	16.6	16	8.5	7.5	56.25
4	20.1	20.8	15	15	0	0
5	18.9	29.4	14	17	3	9
6	18.8	20.5	13	13	0	0
7	18.3	18.7	12	10	2	4
8	18.0	16.6	11	8.5	2.5	6.25
9	17.6	19.7	10	12	2	4
10	17.4	22.3	9	16	7	49
11	16.5	15.5	7.5	7	.5	.25
12	16.5	13.1	7.5	4	3.5	12.25
13	16.1	19.0	6	11	5	25
14	16.0	13.5	5	5	0	0
15	15.2	15.2	4	6	2	4
16	13.8	11.5	3	2	1	1
17	13.2	10.8	2	1	1	1
18	12.6	11.7	1	3	2	4
						$D^2 = 185.0$

$$P = 1 - \frac{6 \times 185}{18\ (324 - 1)}$$

$$P = 1 - \frac{1110}{18\ (324 - 1)}$$

$$P = 1 - \frac{1110}{5814}$$

$$P = 1 - .19$$

$$P = .81*$$

*Significant above .8

TABLE 3

SPEARMAN RHO OF
VISUAL AND AUDIO RT
OF MENTALLY DISABLED STUDENTS

N	Visual RT	Audio RT	RTX	RTY	Diff (x-y)	$Diff^2$
1	34.3	38.2	18	18	0	0
2	27.0	26.8	17	17	0	0
3	25.8	23.3	16	16	0	0
4	24.5	17.8	15	9	6	36
5	21.8	17.0	14	7	7	49
6	21.2	20.3	12.5	15	2.5	6.25
7	21.2	19.1	12.5	12	0.5	0.25
8	20.8	19.7	11	14	3	9
9	19.3	18.6	10	11	1	1
10	18.5	19.6	9	13	4	16
11	18.4	18.4	7.5	10	2.5	6.25
12	18.4	16.7	7.5	6	1.5	2.25
13	15.4	15.3	6	5	1	1
14	15.1	17.5	5	8	3	9
15	13.2	14.6	4	4	0	0
16	12.2	12.6	3	3	0	0
17	12.1	10.9	2	2	0	0
18	11.5	9.8	1	1	0	0
						$D^2 = 136.0$

$$P = 1 - \frac{6 \times 136}{18\ (324 - 1)}$$

$$P = 1 - \frac{816}{18\ (324 - 1)}$$

$$P = 1 - \frac{816}{5814}$$

$$P = 1 - .14$$

$$P = .86*$$

*Significant above .8

Although a positive pattern of responses was demonstrated within each group, the Spearman Rho procedure failed to provide the significance of the relationship or the extent of the differences, if any, between the groups. To determine the significant differences of the reaction time scores to each variable, a t-test was employed by comparing the reaction time mean score for each group with the reaction time mean score with each of the other groups by each variable (audio and visual) separately.

This comparison followed the following format:

1. Audio L.D. with Audio Reg.
2. Audio Reg. with Audio M.D.
3. Audio L.D. with Audio M.D.
4. Visual L.D. with Visual Reg.
5. Visual Reg. with Visual M.D.
6. Visual L.D. with Visual M.D.

A two-tailed t-test for correlated data with an alpha level of .01 was used since the direction of difference, if any, was not known.

The null hypothesis for this test was:

$$H_0: \overline{\Delta} = 0$$

The alternative hypothesis was:

$$H_1: \overline{\Delta} > 0$$

Where: The mean differences of reaction time ($\overline{\Delta}$) = the mean across subjects by group. (See tables 4, 5, and 6.)

The results of these t-tests describe the relationship of audio and visual reaction time scores between the groups, compared

TABLE 4

T-TESTS FOR LEARNING DISABLED AND REGULAR STUDENTS FOR AUDIO RT
and
LEARNING DISABLED AND REGULAR STUDENTS FOR VISUAL RT

Variable	Number of Cases	Mean	Standard Deviation	Standard Error	F Value	2-Tail Prob.	POOLED VARIANCE ESTIMATE T Value	Degrees of Freedom	2-Tail Prob.
AUDIO									
L.D.	18	19.3500	5.739	1.353	1.04	.936	.58	34	.567
Reg.	18	18.2333	5.853	1.380					
VISUAL									
L.D.	18	20.8833	6.543	1.542	2.13	.129	1.48	34	.148
Reg.	18	18.1167	4.483	1.057					

TABLE 5

T-TESTS FOR REGULAR STUDENTS AND MENTALLY DISABLED STUDENTS TO AUDIO RT
and
REGULAR STUDENTS AND MENTALLY DISABLED STUDENTS FOR VISUAL RT

Variable	Number of Cases	Mean	Standard Deviation	Standard Error	F Value	2-Tail Prob.	POOLED VARIANCE ESTIMATE T Value	Degrees of Freedom	2-Tail Prob.
AUDIO									
Reg.	18	18.2333	5.853	1.380	1.17	.744	-.24	34	.809
M.D.	18	18.7278	6.344	1.495					
VISUAL									
Reg.	18	18.1167	4.483	1.057	1.81	.233	-.56	34	.582
M.D.	18	19.1000	6.025	1.420					

TABLE 6

T-TESTS FOR LEARNING DISABLED AND MENTALLY DISABLED STUDENTS FOR AUDIO RT
and
LEARNING DISABLED AND MENTALLY DISABLED STUDENTS FOR VISUAL RT

Variable	Number of Cases	Mean	Standard Deviation	Standard Error	F Value	2-Tail Prob.	POOLED VARIANCE ESTIMATE T Value	Degrees of Freedom	2-Tail Prob.
AUDIO									
L.D.	18	19.3500	5.739	1.353	1.22	.684	.31	34	.760
M.D.	18	18.7278	6.344	1.495					
VISUAL									
L.D.	18	20.8833	6.543	1.353	1.18	.738	.85	34	.401
M.D.	18	19.1000	6.025	1.420					

one to another. In each of the t-tests, the null hypothesis was retained since no significant differences of mean scores for each variable were revealed between any of the groups as they were compared, one to another. It may be further stated that in each of the six two-way comparisons of each of the mean variable scores of the three groups no significant differences among mean variable scores were found.

Since each t-test would only compare the mean variable score of one group to the same mean variable score of one other group, no comparison of the variables across all the groups could be made with this procedure. Therefore, a single-factor analysis of variance (ANOVA) was used to examine each variable (audio/visual) independently as it functioned separately across the total population of all three groups and multiple-factor analysis of variance to examine both variables (audio plus visual) in combination as they functioned collectively across the total population of all three groups. This analysis would reveal the extent of interaction any of the variables (audio, visual, or total population mean scores) may have displayed upon one another, either in dual or multiple combinations.

The null hypothesis for the analysis of variance was:

$$H_0 = \mu_A = \mu_C \quad \text{(ANOVA 1)}$$

$$H_0 = \mu_B = \mu_C \quad \text{(ANOVA 2)}$$

$$H_0 = \mu_A = \mu_B = \mu_C \quad \text{(ANOVA 3)}$$

The alternative hypothesis was:

$H_1 = \mu_A = \mu_C$ (ANOVA 1)

$H_1 = \mu_B = \mu_C$ (ANOVA 2)

$H_1 = \mu_A = \mu_B = \mu_C$ (ANOVA 3)

Where:

A = Visual RT (Grand Mean)
B = Audio RT (Grand Mean)
C = Group (Total N Grand Mean)

(See tables 7, 8, and 9.)

TABLE 7

ANALYSIS OF VARIANCE OF AUDIO REACTION TIME
for
L.D., REG., AND M.D. STUDENTS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	11.271	2	5.636	.157	.855
Var 01	11.271	2	5.636	.157	.855
Explained	11.271	2	5.636	.157	.855
Residual	1826.561	2	35.815		
Total	1837.833	53	34.676		

TABLE 8

ANALYSIS OF VARIANCE OF VISUAL REACTION TIME
for
L.D., REG., AND M.D. STUDENTS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	70.810	2	35.405	1.071	.350
Var 01	70.810	2	35.405	1.071	.350
Explained	70.810	2	35.405	1.071	.350
Residual	1686.490	51	33.068		
Total	1757.300	53	33.157		

TABLE 9

ANALYSIS OF VARIANCE OF AUDIO AND VISUAL REACTION TIME
for
L.D., REG., AND M.D. STUDENTS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	28.622	1	28.622	2.243	.144
Var 01	28.622	1	28.622	2.243	.144
Main Effects	1320.412	20	66.021	5.175	.001
Var 03	1320.412	20	66.021	5.175	.001
Explained	1349.034	21	64.240	5.035	.001
Residual	408.266	32	12.758		
Total	1757.300	53	33.157		

Again the null hypothesis for each of the H's was retained. The analysis of variance revealed no significant difference of interaction on either response variable mean since each was compared to the combined variable grand mean for the total population. There were also no significant differences of interaction as both variable means were compared to the combined variable grand mean for the total population. This is interpreted to mean that when the grand means of the variables are compared together in any possible combination, no significant differences emerge; therefore, it is concluded that one variable contributes no more to variance than another variable to any significant level.

A final analysis of the data was made in order to determine whether or not either or both of the variables (reaction time scores to audio and visual stimuli could be utilized as a predictor for the assignment of a student to one of the three groups. In other words, could membership in a particular group (either L.D., Reg., or M.D.) be established by the reaction time score(s) to an audio and/or visual stimuli obtained by any one student? To accomplish this a three-way multiple correlation was calculated.

This correlation procedure involved the following format:

Multiple 1

r_1 = audio scores (grand mean of all groups)
r_2 = L.D. (Mean of N)
r_3 = Reg. (Mean of N)
r_4 = M.D. (Mean of N)

Multiple 2

r_1 = visual scores (grand mean of all groups)
r_2 = L.D. (Mean of N)
r_3 = Reg. (Mean of N)
r_4 = M.D. (Mean of N)

Multiple 3

r_1 = visual mean scores (grand mean of all groups)
r_2 = audio mean scores (grand mean of all groups)
r_3 = combined mean scores of total N (grand mean of all groups for both responses)

(See tables 10, 11, and 12.)

The following multiple correlation results were established:

Multiple 1 revealed a low correlation (Multiple R). This is interpreted to mean that the audio reaction time score of any one students did not reveal his/her membership in any particular group. This further means that a student's membership in any group among the three groups could not be predicted by his/her audio reaction time score.

Multiple 2 revealed a low correlation (Multiple R). This is interpreted to mean that the visual reaction time score of any one student did not reveal his/her membership in any particular group. This further means that a student's membership in any group among the three groups could not be predicted by his/her visual reaction time score.

Multiple 3 revealed a high correlation (Multiple R). This is interpreted to mean that the visual reaction time score of any student was positively correlated with the audio reaction time score of that same student, regardless of group membership. This further means that a student's membership in any group among the three groups could not be predicted by his/her combined visual and audio reaction time scores, even though those two scores are highly correlated.

TABLE 10

ALL GROUPS-AUDIO
MULTIPLE CLASSIFICATION ANALYSIS
Var 03-Audio
Var 01-Group
Grand Mean = 18.77

Variable + Category	N	Unadjusted Dev ≠ N	Eta	Adjusted for Independents Dev ≠ N	Beta
Var 01					
1	18	.58		.58	
2	18	- .54		- .54	
3	18	- .04		- .04	
			.08		.08
Multiple R Squared					.006
Multiple R					.078

TABLE 11

ALL GROUPS-VISUAL
MULTIPLE CLASSIFICATION ANALYSIS
Var 02-Visual
Var 01-Group
Grand Mean = 19.37

Variable + Category	N	Unadjusted Dev ≠ N	Eta	Adjusted for Independents Dev ≠ N	Beta
Var 01					
1	18	1.52		1.52	
2	18	- 1.25		- 1.25	
3	18	- .27		- .27	
			.20		.20
Multiple R Squared					.040
Multiple R					.201

TABLE 12

ALL GROUPS-VISUAL-AUDIO
MULTIPLE CLASSIFICATION ANALYSIS
Var 02-Visual
Var 03-Audio
Var 01-Group
Grand Mean = 19.37

Variable + Category	N	Unadjusted Dev ≠ N	Eta	Adjusted for Independents + Covariates Dev ≠ N	Beta
Var 03					
9	1	- 7.87		- 7.55	
10	2	- 6.72		- 6.56	
11	3	- 6.73		- 6.84	
12	1	- 7.17		- 6.85	
13	4	- 4.37		- 4.53	
14	3	- 2.37		- 2.47	
15	4	- 2.82		- 2.82	
16	5	.09		.03	
17	4	- .39		- .23	
18	4	- 1.14		- 1.06	
19	6	- .33		- .23	
20	4	1.36		1.44	
21	3	5.93		5.62	
22	1	- 1.97		- 1.97	
23	2	5.48		5.48	
24	1	2.93		2.62	
26	1	7.63		7.95	
29	1	- .47		- .47	
31	2	10.93		10.62	
32	1	13.03		13.03	
38	1	14.93		15.25	
			.88		.87
Multiple R Squared					.768
Multiple R					.876*

*Significant above .8

A composite interpretation of the three multiple classification exhibits that a student's variable score(s), either singly or combined is (are) not a valid predictor of that same student's group membership. Students' scores in one group are so closely approximate to students' scores in another group that no accurate prediction can be made as to whether a student is learning disabled, regular, or mildly mentally retarded.

In summary, the data was analyzed using the following procedures:

1. A linear frequency distribution graph of audio reaction time scores and visual reaction time scores was used for each group. The graphs showed visually identifiabled relationships of audio scores and visual scores between or among all groups.

2. A Spearman Rho correlation comparing rank-order correlations of each variable within each group. It showed that a person who had a certain speed to a reaction time of an audio stimuli also had the relative same reaction time to a visual reaction time.

3. A t-test was employed to compare mean scores of each group on each variable with the mean scores of each of the other groups on the same variable. The results showed that no significant differences were found of mean scores for each variable between any of the groups as they were compared one to another.

4. An analysis of variance was used to compare the mean scores of each variable across all three groups. The results revealed no significant difference of mean scores across all three groups.

5. A multiple correlation comparing the predictive value of each variable (audio and visual) to group membership and the predictive value of combined variables to

group membership. The results showed that a student's membership in any of the three groups cannot be accurately predicted by that student's reaction time score(s).

In Chapter Five a summary of this report will be presented. Conclusions that can be made from this report will also be presented. Finally, recommendations as a direct result of this investigation will be discussed in the next chapter.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The presentation and analysis of the data were presented in the preceding chapter. The data were extracted from the reaction time scores of fifty-four junior high school students to audio and visual stimuli. Three groups of eighteen students from populations classified as learning disabled, regular, and mildly mentally disabled were selected for this research.

The findings from the data in this study are as follows:

1. The reaction times of the three groups are similar as portrayed in a grid profile.

2. The relationship between and among the three groups were similar on all comparisons for reaction times to both an audio stimuli and a visual stimuli.

    (a) If a students scored slowly, moderately, or rapidly to an audio stimuli, he/she also scored slowly, moderately, or rapidly to a visual stimuli.

    (b) If a student scored slowly, moderately, or rapidly to both stimuli, then the reaction time was similar across and common among all groups. That is, reaction time scores were evenly distributed <u>within each</u> group and reaction time scores were nearly the same or identical <u>between each</u> group. This may be further stated as:

        (1) Slow responding students to an audio and/or visual stimuli in one group were similar or equal in scoring to slow responding students to the same stimuli in the other groups.

        (2) The same as in (1) above holds for the moderate and rapid responding students.

3. No significant differences were found within or between the groups compared on any of the following bases:

   (a) Reaction time to an audio stimuli for any single group to any other single group.

   (b) Reaction time to a visual stimuli for any single group to any other single group.

   (c) Interaction of reaction time to either stimuli (audio and/or visual) among all the groups (L.D., Reg., and M.D.).

4. A student's reaction time scores to an audio stimuli or a visual stimuli, either separately or in combination, cannot accurately predict that student's membership in a particular group as classified as either L.D., Reg., or M.D.

It may, therefore, be stated that reaction time to an audio and/or a visual stimuli may vary from student to student; however, such similarity or variance is neither dependent upon nor an operation of the classification of that student at the junior high school level as either learning disabled, regular, or mildly mentally retarded. It may be further stated that a student's membership in any of these groups cannot be accurately predicted by that student's reaction time score(s).

CONCLUSIONS

The following conclusions can be made that are a direct result of this investigation:

1. No one group (L.D., Reg., and M.D.) showed significantly higher or lower reaction time scores to audio or visual stimuli.

2. Group placement (L.D., Reg., and M.D.) had no significant impact on an individual's reaction time scores to audio or visual stimuli.

3. No accurate predictions with respect to placement (L.D., Reg., and M.D.) can be made based upon either of his/her reaction time scores to audio and/or visual stimuli.

4. If a person scored slowly, moderately, or rapidly to audio stimuli, he/she also scored slowly, moderately, or rapidly to a visual stimuli.

RECOMMENDATIONS

On the basis of this investigation, the following recommendations are offered:

1. Further research is needed with reaction time to audio and visual stimuli. A wider population base should be employed when doing further investigations.

2. More complex audio and visual stimuli should be used in further research studies.

3. Testing for physical impairments should be done to enhance any further research.

4. More well defined selection and placement processes should be employed.

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BIBLIOGRAPHY

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APPENDICES

APPENDIX A

LETTER OF APPROVAL FROM DES MOINES SCHOOL DISTRICT

DES MOINES PUBLIC SCHOOLS
1800 GRAND AVENUE
DES MOINES, IOWA 50307

ROBERT R. DENNY,
ASSISTANT SUPERINTENDENT
FOR EDUCATION

50

November 28, 1977

Mr. Theodore Nemmers
3322 East Jefferson
Des Moines, Iowa 50317

Dear Mr. Nemmers:

We received your application to do research in the Des Moines Public Schools. Dr. Wetter, director of secondary education, has reviewed and approved your application. You should contact Mr. Tuller to make the necessary arrangements involved in your research.

Upon completion of your research, you are requested to send an abstract of your findings to the school involved and two copies of the abstract to my office. If there are questions, or if we could be of further assistance, contact Sharon J. Castelda (284-7727).

We wish you success in your endeavor.

Sincerely,

Sharon J. Castelda

Sharon J. Castelda
Administrative Assistant

gc

cc: Dr. Wetter, Director, Secondary Education
Mr. Tuller, Principal, Wilson Jr. High

APPENDIX B

LETTER TO PARENTS REQUESTING CHILDREN'S PARTICIPATION IN THE STUDY

LETTER TO PARENTS

December 5, 1977

Dear Parents:

I am a Mental Disabilities teacher at Wilson Junior High School. I am also participating in an Education Specialist Degree at Drake University in the area of Public School Administration.

In partial fulfillment of the requirements for my degree, I developed a study to measure reaction times of students in the mentally disabled, learning disabled, and the regularly placed students. The students will be asked to push a button when they see a light appear. The time it takes to push the button will be measured and recorded. In order, not to interfer with your student's daily school routine, all testing will be done during their scheduled physical education class.

The proposal for this research has been submitted to and approved by the Drake School of Graduate Studies, the Des Moines Office of Education, and Mr. Richard Tuller, principal at Wilson.

If you have any objections to your childs' inclusion in the testing, please send a note to that effect or I will assume I have your approval. I will gladly answer any questions you may have concerning this study. You may contact me at Wilson, 266-5135, or at my home, 266-6685.

Thank you for your consideration.

Sincerely,

Theodore J. Nemmers